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Pan-Pacific Cooperation of International Union of Geodesy and Geophysics

(Officially Communicated)

Ten countries bordering on the Pacific were represented at the third triennial meeting of the International Union of Geodesy and Geophysics held at Prague, Czecho Slovakia, September 3-10.

The following is a list of the accredited representatives:

Argentina: Gen. Fernandes, Aquilar, Holmberg.

Japan: M. Hasimoto, A. Imamura, W. Oishi, K. Suda, A. Tanakadate, H. Tanakadate.

Mexico: Pedro C. Sanchez.

New Zealand: Andrew Thomson.

Peru: E. Caballero y Lastres.

Siam: W. M. Gilmore, J. Bhakdikul.

S. S. S. R.: Paul Nikiforof, Uljanin.

United States: L. A. Bauer, W. Bowie, John Howard Dellinger, Harry F. Reid, N. H. Heck, W. D. Lambert, L. C. Graton, A. B. Cook, H. H. Kimball.

Australia and Canada were represented by Col. H. St. J. Winterbotham of the British delegation.

Altogether over thirty nations were represented by 300 delegates.

The main purposes of the International Geodetic and Geophysical Union are: (1) To promote the study of problems relating to the shape and physics of the earth, and (2) to initiate, organize and facilitate the conduct of researches which depend on the cooperation between different stations.

The meeting which has just been held at Prague amply carried out these high aims. It is impossible, however, to summarize in brief space the activities of the eight sections of the Union now organized, Geodesy, Seismology, Terrestrial Magnetism and Electricity, Volcanology, Hydrology, Oceanography and Meteorology. There were few lengthy reports, the program being more in the nature of a discussion of refinements in observation and in the reduction of computations and of fields of investigations not touched by existing national organizations. At the close of these discussions a committee was appointed in general who were charged with the preparation of a final report. Thus in the Meteorology section a committee was appointed to prepare a daily synoptic map of the Southern Hemisphere for a period of three months. The section of Terrestrial Magnetism appointed a committee under the chairmanship of C. Storner to prepare an atlas of auroral forms similar to the International Cloud Atlas. This will overcome the difficulty in describing streamers and arcs. Of special interest to those in the Pacific was the report given by the Dutch physicist Meinesz on the determination of gravity on his voyage from Panama to Honolulu and the Dutch Indies.

The work of the International Geodetic and Geophysical Union is very similar to that of the Pan-Pacific Conference. The closest sympathy and cooperation between these organizations and methods of scientific procedure may is desired in order that the conventions be worldwide.

Guide to the Plant Groups in Hawaii

By E. H. Bryan, Jr.

In 1922, while teaching General Biology at the Kamehameha Schools, the writer made for the students the following summary of the Hawaiian flora. Its object is to give a ready reference to the more important groups of Hawaiian plants, both native and introduced. It does not attempt to list all the families of plants to be found in these islands, nor all the genera in the families given. No attempt is made to give specific names. Some genera have one species, others many. Different common or native names may refer to different species of the same genus. For a more complete account of the plants of Hawaii the student should consult:

Hillebrand, Flora of the Hawaiian Islands, 1888. Botanical descriptions of all the plants known in the islands at that time.

Rock, Indigenous Trees of the Hawaiian Islands, 1913. A well-illustrated and complete account of the native trees.

Rock, Ornamental Trees of Hawaii, 1917. Beautifully illustrated book on the introduced and lowland trees, palms and shrubs.

Throughout this list reference is given to available articles on the various groups of plants. At the end is a list of other readable references to Hawaiian plant life.

I. THALLOPHYTES. The plant body a thallus, one or many celled, but not differentiated into root, stem and leaf. Reproduction may be either asexual, by simple cell division or budding, or by the uniting of two cells to form a sexual spore.

A. ALGAE, marine or fresh water Thallophytes, *with chlorophyll.* Includes a great variety of seaweeds (limu), spirogyra, pond scum, etc.

For accounts of the Hawaiian Algae, see:

Chamberlain, Algae of the Hawaiian Islands, Hawaiian Annual, 1881, p. 32.

Bailey and Harvey, Report, U. S. Exploring Expedition, Vol. XVI, pp. 153-192.

Tilden, Collection of Algae from the Hawaiian Islands, Hawaiian Annual, 1902, p. 111.

Setchell, University of California Publications, Vol. 2, No. 3, pp. 91-113, 1905.

Reed, Report, Hawaii Agricultural Experiment Station, 1906, pp. 61-88.

MacCaughey, Seaweeds of Hawaii, American Journal of Botany, 3, p. 447, 1916.

McCaughey, Algae of Hawaiian Archipelago, Botanical Gazette, Vol. 65, pp. 42, 121, 1918.

B. FUNGI, *without chlorophyll,* mostly terrestrial. Include mushrooms, molds, etc. Many species occur in the native forests, as well as those attacking cultivated plants and stored products. For the natives species, see:

Ellis, Torrey Botanical Club Bulletin, Vol. 22, p. 10, 1895.

Burt, Higher Fungi, Missouri Botanical Garden, Ann. v. 10, pp. 179-189, 1923.

Speare, Phytopathology, vol. 2, pp. 135-7, 1912.

Stevens, Bishop Museum Bulletin 19, 1925.

Those of economic importance are discussed in the papers on plant pathology.

C. LICHENS, certain groups of Fungi which are intimately associated with and parasitic upon certain lowly Algae. They appear as crusts, scaly patches or bush-like areas on trees, rocks or the ground. Common throughout the islands.

See: Bailey, Hawaiian Annual, 1887.

Tuckerman, Proceedings, American Academy of Arts and Sciences, VII, pp. 223-5, 1867.

II. BRYOPHYTES, mosses and liverworts. Differ from Thallophytes in that the gametes (male and female cells) are different, and that they pass through a definite alternation of generations; *i. e.* two distinct forms of growth, one produced by and parasitic upon the other.

A. HEPATICI, liverworts. Small, primitive Bryophytes, common in rain-forest, on leaves or stems, or epiphytic on bark. See:

Austin, Torrey Botanical Club Bulletin, vol. 5, pp. 14-18, 1874.

Baldwin, Hawaiian Annual, 1877, p. 42.

Evans, Connecticut Academy of Arts and Sciences VII, pp. 1-9, 1891.

Evans, Connecticut Academy of Arts and Sciences, X, pp. 387-460, 1900.

Cooke, Connecticut Academy of Arts and Sciences, XII, pp. 1-45, 1904.

B. MUSCI, mosses. Before forming the "moss" there is a preliminary, much branching growth, resembling Algae. For Hawaiian mosses, see:

Baldwin, Hawaiian Annual, 1877, pp. 40-42.
Williams, Torrey Botanical Club Bulletin, vol. 42, pp. 576-7, 1915.
Brotherus, Hawaiian Mosses, B. P. Bishop Museum Bulletin 40, 1927.

III. PTERIDOPHYTES, ferns, ground pine, etc. Spore bearing plants, differing from Bryophytes in that the Sporophyte (spore bearing plant) is the larger, more showy stage, and develops roots. The Gametophyte (plant bearing egg and sperm) is usually a small, green, heart-shaped thallus, resembling a liverwort.

A. FILICALES, true ferns. The most common genera in Hawaii are:
Marattia, "pala" fern; glossy, dark green leaves, 3 to 5 feet long.
Gleichenia, stag-horn or uluhi fern; widespread in lower forest. MacCaughey, Torrey, vol. 18, pp. 41-52, 1918.
Cibotium, giant tree fern or hapu; sometimes 20 to 30 feet high.
Acrostichum, ekaha or hoea Maui.
Polypodium, kolokolo, kihe, pai, wahine noho mauna, etc.
Aspidium, kaupu, kaapeape, kikawaeo, laukahi, etc.
Sadleria, smaller tree ferns, amaumau.
Asplenium, bird's-nest fern, ekaha; a large group in Hawaii.
Pteris, brake or eagle fern, kilau.
Adiantum, maiden hair fern or iwaiwa; one species formerly used for making hats.

B. OPHIOGLOSSACEAE, very primitive ferns; the gametophyte grows underground, while the sporophyte has a short upright stem.
Ophioglossum, adder's tongue, pololei and laukahi.
Botrychium, makou.

C. LYCOPODIACEAE, ground pine and club mosses. These are the small descendents of gigantic prehistoric, tree-like plants, whose trunks helped to form the coal beds.
Lycopodium, ground pine or "mouse's foot," wawae iole; extensively used as a Christmas decoration and for wreaths.
Selaginella, similar, but with minute scale-like leaves in spirals.
References to Hawaiian Pteridophytes:
Hillebrand, Flora of Hawaiian Islands, 1888, pp. 539-651.
Lydgate, Short synopsis of Hawaiian Ferns, 1873.
Bailey, Hawaiian Ferns, 62 pages, 1882 (Published by Thrum, Honolulu).
Yates, Notes on Hawaiian Ferns, 1887 (Santa Barbara, Calif.).
Lyon, Key to genera and species, Hawaiian Annual, 1897, pp. 76-87.
Copeland, Hawaiian Ferns, Philippine Journal of Science, IX., pp. 435-441, 1914, and XI, pp. 170-173, 1916.
Robinson, Torrey Botanical Club Bulletin, 39, pp. 227, 567, 1912; 40, p. 193, 1913; 41, p. 51, 1914 (Illustrated).
MacCaughey, Tree Ferns of Hawaii, American Botanist, 22, pp. 1-9, 1916.
MacCaughey, Journal of Ecology, VI, pp. 199-219, Nov., 1918.
Christensen, Revised List of Hawaiian Pteridophyta, B. P. Bishop Museum, Bull. 25, 1925.

IV. SPERMATOPHYTES, seed bearing or flowering plants. Sporophyte fully developed. With roots, stem, leaves, flowers, etc.

A. GYMNOSPERMS, primitive flowering plants with unisexual flowers, naked or uncovered ovules (fertilized by direct application of pollen), and with naked, unenclosed seeds, with two or more cotyledons.
1. CYCADACEAE, cycads or (erroneously called) "sago palms." Much resembling tree ferns; male plant with bright orange cone at base of leaves. See: Rock, Ornamental Plants of Hawaii, pp. 1-4.
2. PINACEAE (Pine family). No native conifers in Hawaii. Introduced:
Cupressus, evergreen cypress.
Araucaria, Norfolk Island pine or "monkey puzzle" tree.
Agathis, Kauripine, from New Zealand and Australia.

B. ANGIOSPERMS, flowering plants, with seeds enclosed in some pod, capsule or fruit. About 40 per cent of the 280 recognized families are represented in Hawaii.
I. MONOCOTYLEDONS, seeds with one cotyledon; stem soft, fibro-vascular bundles scattered; growth from inside; veins of the leaves parallel.
1. PANDANACEAE.
Pandanus, hala or screw pine; leaves (lau hala) used in weaving.
Balfour, Journal Linnean Society, Botany, vol. 17, pp. 33-68, 1878.
Freycinetia, ieie vine; a woody climber in lower rain forest.
2. GRAMINEAE (Grass family). A very large group, including sugar cane,

corn, grains, bamboo, sorghum, grasses, etc. See:
Hillebrand, Flora of Hawaiian Islands, pp. 489-538, 1888.
McClelland, Hawaii Agricultural Experiment Station Bulletin 36, 1915.
Hitchcock, Grasses of Hawaii, Bishop Museum Memoir, VII, No. 3, 1922.

3. CYPERACEAE (Sedge family). Fifteen or more genera of grass-like or rush-like herbs, with three-sided solid stems. They include such native sedges as: ehuawa, kaluha, pipiwai, kohekohe, akaakai, puukoa, kuolohia, etc. See:
Hillebrand, Flora of Hawaiian Islands, pp. 459-489, 1888.

4. PALMAE (Palm family).
Pritchardia, native or loulu palm. See:
Beccari and Rock, Monographic Study, Bishop Museum Memoir, VIII, No. 1, 1921.
McCaughey, Plant World, Vol. 21, pp. 317-28, 1918.
Cocos, coconut palm or niu; introduced in lowlands, especially near the shore.
Phoenix, date palm; introduced.
For other palms, see:
Rock, Ornamental Trees of Hawaii, pp. 10-57.
MacCaughey, Hawaiian Forester and Agriculturist, 9, pp. 17, 66, 79, 1912.

5. ARACEAE (Aroids).
Colocasia, taro or kalo. See, MacCaughey, 12 papers on taro and its growth, Hawaiian Forester and Agriculturist, vols. 10, 11, 1914, and 14, 1916.
Miller, Food value of poi, taro and limu, B. P. Bishop Mus., Bull. 37, 1927.
Alocasia, ape or giant taro.

6. BROMELIACEAE. Ananassa, pineapple. See:
Higgins, Hawaiian Agricultural Experiment Station, Press Bulletin 36, 1912; and publications of Association of Hawaiian Pineapple Canners, Experiment Station.

7. LILIACEAE (Lily family).
Smilax, uhi or ulehihi, woody climber.
Cordyline, ti or ki; leaves (lai or laui) used for wrapping food in imus; thick, fleshy, sweetish edible root.
Dracaena, halapepe; soft, white wood tree, resembling Pandanus.
Astelia, painui; rush-like, with long, narrow, tough leaves.
Lilium, cultivated lilies.

8. AMARYLLIDACEAE, Agave, sisal or century plant. See:
Wilcox & McGeorge, Hawaiian Agricultural Experiment Station Press Bulletin 35, 1912.

9. TACCACEAE, Tacca, arrowroot or pia; a source of starch.

10. DIOSCOREACEAE, Dioscorea, yam, piia or hoi.

11. MUSACEAE (Banana family).
Musa, banana, plantain, maia; native and introduced species. See:
Higgins, Hawaiian Agricultural Experiment Station Bulletin 7, 1904; Bulletin 55, 1926; MacCaughey, Plant World, vol. 21, pp. 1-12, 1918.
Ravenala, traveller's tree. See: Rock, Ornamental Trees, page 59.

12. CANNACEAE, Canna, indian shot or aliipoe; one kind with edible root. See: Hawaiian Agricultural Experiment Station Bulletin 54, 1924.

II. DICOTYLEDONS, seeds with two cotyledons; exogenous stem (with bark, wood, pith, etc.), the fibro-vascular bundles in layers, forming annular rings; growth from outside; leaves with netted veins.

1. PIPERACEAE (Pepper family).
Piper, ava or kava plant; root used in preparing stimulating drink.
Peperomia, alaalawainui. See, de Candolle and Rock, College of Hawaii Bulletin 2.

2. CASUARINACEAE, Casuarina, she oak, or "ironwood"; leafless trees resembling pines.

3. URTICACEAE (Nettle.family) (Considered part of Moraceae by some botanists.)
Pipturus, mamake; small, shrubby tree; tapa fiber plant.
Broussonetia, wauke, paper mulberry; shrub, fiber used for tapa.
Urera, opuhe; tall shrub or small tree; valuable fiber plant.
Touchardia, oloná, "unexcelled fiber plant"; see MacCaughey, Science, vol. 48, pages 236-8, 1918.
(These fiber plants are discussed by Brigham, Bishop Museum Memoirs, vol. 3, pages 117-182, 1911.)

4. MORACEAE (Mulberry family).
Morus, black mulberry, kilika; also cultivated mulberry tree.
Pseudomorus, Hawaiian false mulberry, ai-ai.
Artocarpus, breadfruit, ulu; also the jackfruit. See, MacCaughey, Torrea, vol. 17, pages 33-48, 1917. (Sometimes placed in Artocarpaceae.)

Ficus, figs, banyan, India rubber tree.

5. SANTALACEAE (Sandalwood family).
   Santalum, sandalwood, iliahi. Rock, Sandalwoods of Hawaii, Hawaii Board of Agriculture and Forestry, Botanical Bulletin 3, 1916.
   Skottsberg, B. P. Bishop Mus., Bull. 43, 1927.
   Exocarpus, heau tree.
6. POLYGONACEAE (Buckwheat family).
   Rumex, sorrel or dock, puwaale, uhauhako; coarse herbs.
   Polygonum, knotweed, kamole; an herb.
7. AMARANTACEAE (Amaranth family).
   Charpentiera, papala; trees 15 to 35 feet tall.
   Nototrichium, kului; trees 8 to 20 feet tall.
   Amaranthus, spiny amaranth; common weed.
8. NYCTAGINACEAE (Four o'clock family).
   Mirabilis, four o'clocks; roadside weeds and garden plants.
   Pisonia, papala kepau; trees, furnishing glue for bird catching.
   Bougainvillea, cultivated flowering shrub; purple and reddish floral bracts.
9. ANONACEAE, Anona, sour sop, custard apple, sweet sop, cherimoyer, etc. See, MacCaughey, Torrea, vol. 17, pages 69-76, May, 1917.
10. LAURACEAE (Laurel family).
    Cryptocarya, holio tree, 18 to 30 feet high.
    Persea, avocado, see Higgins, Hawaii Agric. Experiment Station Bulletin 25, 1911.
    Cinnamomum, introduced cinnamon and camphor trees; Rock, Ornamental Trees, p. 72.
11. CRUCIFERAE (Mustard family; mostly introduced weeds in Hawaii).
    Lepidium, pepperwort, garden cress, anounou; herbs, weeds.
    Senebiera, peppergrass; a weed common in gardens.
    Nasturtium, watercress.
    Brassica, mustard, cabbage, rape, turnip.
12. CRASSULACEAE, Bryophyllum, air plant; see MacCaughey, Hawaiian Forester and Agriculturist, vol. 9, pages 10-16, 1912.
13. PITTOSPORACEAE, Pittosporum, hoawa; forest trees with coarse leaves and wrinkled fruit.
14. ROSACEAE (Rose family).
    Osteomeles, uulei; trees and shrubs with edible white berries and fragrant flowers; widely distributed in the rainforest.
    Rubus(raspberry, thimbleberry, blackberry, akala berry; see, Rock, Journal of Hederity, vol. XII, pages 147-150, 1921.
    Also includes rose, apple, pear, plum, peach, apricot, loquat, strawberry, etc. (some of which are classed as Pomaceae, Drupaceae, etc.).
15. LEGUMINOSAE (Bean family).
    For a complete, well illustrated account of this immense group in Hawaii, see:
    Rock, Leguminous plants of Hawaii, H.S.P.A., July, 1920. See also:
    Rock, Ornamental trees of Hawaii, pages 76-120; Rock, Board of Agriculture and Forestry, Botanical Bulletin 5, 1919; Krauss, Leguminous crops for Hawaii, Hawaii Agricultural Experiment Station, Bulletin 23, 1911.
    Some of the more important genera in Hawaii are:
    Acacia, koa, koaia, klu, black wattle, Australian blackwood, etc.
    Prosopis, algaroba or kiawe; Judd, Hawaiian Forester and Agriculturist, vol. XII, pages 330-3, 1916; Wilcox, Hawaii Agric. Experiment Station, Press Bulletin 26.
    Cassia, golden, pink, and pink and white showers, heuhiuhi; trees and shrubs.
    Caesalpinia, kakalaioa, bonducella, "wait-a-bit," vines with spiny pods; Pride of Barbados, a shrub.
    Delonix, royal poinciana; ornamental tree.
    Pithecolobium, opiuma or Manila tamarind tree.
    Samanea, monkey-pod or rain tree.
    Albizzia, siris tree.
    Leucaena, haole koa or false koa, with creamy pompons.
    Mimosa, "sensitive plant" or hilahila; leaves curl up when touched.
    Tamarindus, tamarind tree.
    Bauhina, St. Thomas tree; several species cultivated.
    Sophora, mamani; large tree, abundant in upper forest zones.
    Crotalaria, rattle-pod or rattle-box; weeds.
    Medicago, alfalfa, bur clover, lucerne, trefoil; forage plants.
    Trifolium, clover.
    Indigofera, indigo plant.

Tephrosia, ahuhu, auhola, hola; shrub often confused with indigo.
Sesbania, ohai; a cultivated tree.
Piscidia, fish poison tree.
Erythrina, wiliwili, coral tree; light wood and red seeds.
Mucuna, velvet bean, kaeee.
Canavalia, awikiwiki, puakauhi; also the jack bean.
Phaseolus, lima bean, kidney bean, mung bean.
Vigna, cow peas, and nanea or pulihilihi, a vine along beaches.
Cajanus, pigeon pea; Hawaii Agric. Experiment Station Bull. 46, 1921.

16. GERANIACEAE (Geranium family).
Geranium, nohuanu; large shrubby herbs with silvery leaves; Rock, College of Hawaii Bulletin 1, pages 8-9, 1911.
Pelargonium, common cultivated garden "geranium."

17. RUTACEAE (Orange family).
Pelea, alani, mokehana; large genus of trees.
Platydesma, small trees or shrubs; heavy turpentine odor. See Rock, Pelea and Platydesma, Botanical Gazette, LXV, p. 3, 1918.
Xanthoxylum, heae; small trees or shrubs, often prickly.
(AURANTIACEAE, sometimes considered a separate family from Rutaceae.)
Citrus, orange, lemon, lime, citron, kumquat, grapefruit, etc. See, Higgins, Hawaii Agricultural Experiment Station Bulletin 9, 1905.

18. MELIACEAE (Santol family).
Swietenia, true mahogany; large evergreen tree.
Melia, "Pride of India," bead tree, or Persian lilac.

19. EUPHORBIACEAE (Spurge family).
Euphorbia, poinsettia, koko, akoko; shrubs with milky sap; more or less poisonous.
Ricinus, castor oil plant; seeds are poisonous.
Aleurites, kukui or candle-nut tree, abundant on lower edge of forest; see, Wilcox, Hawaii Agricultural Experiment Station, Bulletin 39, 1913.
Antidesma, hame, mehame or ha'a; trees.
Acalypha, introduced hedge plant with copper-red leaves.
Manihot, tapioca plant or cassava, cara rubber tree.
Codiaeum, so-called "Croton"; hedge shrub with variegated leaves.

20. ANACARDIACEAE (Mango family).
Mangifera, mango; Higgins, Hawaii Agricultural Experimen Station Bulletin 12, 1906.
Spondias, vi-apple, hog plum, Otaheite apple.
Schinus, mastich or cultivated "pepper tree," Christmas berry; red berries, pinate leaves.
Anacardium, cashew nut; tree.
Rhus, sumach, neneleau; MacCaughey, Torrea, vol. 15, pages 183-5, 1918.

21. AQUIFOLIACEAE, Ilex (or Byronia), kaawau, aiea; Hawaiian "holly."

22. CELASTRACEAE, Perrottetia, olomea or waimea; tree or large shrub.

23. SAPINDACEAE (Soapberry family).
Sapindus, soapberry, aulu, kaulu, ae or manele.
Dodonaea, aalii; cosmopolitan trees or shrubs.
Alectryon, mahoe; tree.
Euphoria, longan; cultivated fruit tree.
Litchi, Chinese litchi; see, MacCaughey, Hawaiian Forester and Agriculturalist, vol. 14, p. 303, 1917; Higgins, Hawaii Agric. Experiment Station Bulletin 44, 1917.

24. RHAMNACEAE (Buckthorn family).
Colubrina, anapanapa, kukuku, kauila; tree with hard red wood.
Alphitonia, kauwila or kauila; tree with hard wood, used for kapa tools.
Zizyphus, jujube tree; thorny, introduced, native of tropical Asia.

25. MALVACEAE (Hibiscus or Mallow family).
Malva, mallow, false geranium, "cheeses"; common weed.
Sida, ilima; herbs and shrubs with yellow flowers.
Abutilon, mao; similar to ilima, but with crown-like capsule.
Hibiscus, rose mallow, hibiscus, roselle, hau tree, akiohala, hauhele, kokio, pualoalo. MacCaughey, Hawaiian Annual, 1917, p. 108; Wilcox, Hawaii Agricultural Experiment Station Bulletin 27, 1913.
Thespesia, milo; common beach tree; fine cabinet wood.
Gossypium, cotton, mao, huluhulu; McClelland and Suhr, Hawaii Agricultural Experiment Station, Press Bulletin 34, 1912.
Kokia, rare, but valuable native red cotton; Rock, Board of Agriculture and Forestry, Botanical Bulletin 1, pp. 8-15; Lewton, Smithsonian Misc. Pub. 60, art. 5, 1912.

26. BOMBACEAE (Bombax family). All

introduced and cultivated.
Bombax, cotton tree.
Ceiba, silk-cotton tree or kapok.
Adansonia, baobab or "bottle tree." (A few cultivated; one each in Kamehameha School and Queen's Hospital grounds.)

27. GUTTIFERAE (Mangosteen family).
Calophyllum, kamani; large leaved beach tree.
Garcinia, mangosteen; MacCaughey, Hawaiian Forester and Agric., vol. 14, p. 125, 1917.
Mammea, mammee apple.

28. VIOLACEAE (Violet family).
Viola, violet, shrubby native species; Rock, College of Hawaii Bulletin 1, pp. 4-7; MacCaughey, Torrea, vol. 18, pp. 1-11, 1918.

29. PASSIFLORACEAE, Passiflora, passion vine, water lemon, lilikoi, granadilla; MacCaughey, Journal of Botany, Dec., 1916, pp. 363-8.

30. CARICACEAE or PAPAYACEAE.
Carica, papaya or papaw; Higgins and Holt, Hawaii Agric. Experiment Station, Bulletin 32, 1914.

31. CACTACEAE (Cactus family).
Opuntia, prickly pear, panini.
Cereus, night blooming cereus.
(Several other cacti are cultivated in gardens.)

32. THYMELIACEAE (Thymel family).
Wikstroemia, akia; tree or shrub with poisonous red berries and small stiff leaves.

33. COMBRETACEAE (Myrobalan family).
Terminalia, false "kamani," Indian "almond" or umbrella tree; edible, almond-like fruit.

34. MYRTACEAE (Myrtle family).
Metrosideros, ohia lehua or lehua; dominant tree in much of the forest; see, Rock, Hawaii Board of Agriculture and Forestry, Botanical Bulletin 4, 1917, MacCaughey, American Forester, vol. 24, pp. 409-18, 1918.
Eugenia (or Jambosa), ohia ai, mountain apple or Malay apple; also, ohia ha, piahi, surinam cherry; rose apple, and many cultivated species. MacCaughey, Torrea, vol. 16, pp. 260-7, 1918.
Psidium, guava, waiawi; escape from cultivation; also cultivated species. MacCaughey, Torrea Botanical Club Bulletin, vol. 44, pp. 513-24, 1917.
Eucalyptus, gum tree; many species introduced from Australia.
Punica, pomegranate.

35. HALORAGACEAE, Gunnera, apè; largest leaved plant in the islands; MacCaughey, American Journal of Botany, vol. 4, pp. 33-9, 1917.

36. ARALIACEAE (Aralia or Ginseng family).
Cheirodendron, olapa, mahu or lapalapa; trees in rainforest.
Pterotropia, oheohe; endemic genus of trees.
Tetraplasandra, ohe; native forest trees.
Reynoldsia, ohe; a shrubby tree, resembling the wiliwili.
Nothopanax, tall hedge shrub with green and white leaves.

37. UMBELLIFERAE (Parsley family).
Several genera and species of herbs and shrubs, including pennywort, makou; such cultivated vegetables as carrots, parsley, parsnips; and various weeds.

38. ERICACEAE (or VACCINIACEAE).
Vaccinium, ohelo berry. See, Skottsberg, B. P. Bishop Museum Bulletin 43, 1927.

39. MYRSINACEAE, Suttonia, kolea; trees in the rainforest.

40. SAPOTACEAE (Milksop or Gutta-percha family).
Sideroxylon, milksop, ala'a, aulu, kaulu; trees and shrubs.
Chrysophyllum, milky trees; star apple, keahi, etc.
Achras, sapodilla or sapota pear.

41. EBENACEAE (Ebony family).
Maba, lama or "native ebony"; native trees with edible seeds and hard wood.
Diospyros, persimmon.

42. OLEACEAE (Olive family).
Osmanthus, pua or ulupua; Hawaiian "olive tree."
Olea, true olive (in cultivation only).
Jasminum, jassamines; vines with ornamental blossoms.

43. APOCYNACEAE (Plumeria family).
Plumeria, pualele, "graveyard flower", frangipanni.
Allamanda, ornamental vines.
Nerium, oleander; cultivated shrubs with ornamental blossoms.
Rauwolfia, hao; small trees or shrubs.
Ochrosia, holei; shrubby native trees.

44. CONVOLVULACEAE (Morning-glory family).
Ipomoea, sweet potato, morning glory, moon-vine, uala, koali, pohuehue, hunakai.
Cuscuta, dodder, palolo; orange colored, leafless parasite on other plants. (By some placed in a separate family, Cuscutaceae.)

45. BORAGINACEAE (Heliotrope family).
Cordia, kou; beach tree; scarlet or orange blossoms, snow white fruit; leaves yield red dye.
Tournefortia, tree heliotrope; lowland tree with small white flowers; common on islands of south Pacific; rare, cultivated, in Hawaii.
Heliotropium, heliotrope; hairy lowland herbs or undershrubs.

46. VERBENIACEAE (Verbena family).
Verbena, vervain; troublesome weed with blue flowers.
Lantana, introduced in 1858, now widely distributed.
Vitex, polinalina, large evergreen tree, the New Zealand teak; also a beach shrub.
Tectona, Indian teak tree.
Clerodendron, roadside weed with pink and white flowers; also "bleeding heart," climber with creamy heart and red corolla; another with scarlet flowers and blue-black berries.

47. LABIATAE (Mint family).
Phyllostegia, kiponapona, much branching undershrub.
Haplostachys, "honohono" (not the grass-like "wandering Jew," which is Commelina, a Monocotyledon).
Stenogyne, maohiohi and mohihi; prostrate or climbing plant.

48. SOLANACEAE (Potato or Nightshade climber.
Solanum, potato, tomato, egg plant, currant tomato, apple of Sodom (poisonous), popolo.
Capsicum, red pepper, bell pepper, etc.
Nothocestrum, aiea; soft wooded trees.
Lycium, aeae, ohelo kai; shrub with edible berries.
Physalis, poha or cape gooseberry; edible fruit.
Datura, kikania, jimson weed, thorn apple (a troublesome weed); also "Angel's trumpet" shrub with large white trumpet-shaped flowers; poisonous.
Nicotiana, tobacco; Hawaii Agric. Experiment Station, Press Bull. 12.
Solandra, "golden cup"; shrubby climber.
Cestrum, Chinese inkberry.

49. BIGNONIACEAE (Bignonia, calabash or trumpet flower family).
Pyrostegia or Bignonia, orange trumpet vine, "cat's claw" climber.
Parmentiera, candle tree; with yellow, candle-like fruits; native of Panama.
Jacaranda, jacaranda trees; with purplish flowers.
Spathodea, "fountain" or "tulip" tree; orange-red flowers.
Crescentia, calabash tree; fruit used for water bottles, cups, etc.
Kigelia, sausage tree; a sacred tree in Africa.

50. GESNERIACEAE.
Cyrtandra, large genus of native shrubs and herbs. See:
Rock, Revision of Hawaiian species of Certandra, American Journal of Botany, vol. 4, pp. 604-23, 1917; vol. 5, pp. 259-77, 1918; vol. 6, pp. 47-68, 181-202, 1919.

51. MYOPORACEAE, Myoporum, naio or naieo, false or bastard sandalwood.

52. PLANTAGINACEAE (Plantain family).
Plantago and Pachyphyllum, plantain, ale; herbs with or without shrubby stem, bearing a rosette of leaves and a flowering spike. Rock, American Journal of Botany, vol. 7, pp. 195-210, 1920.

53. RUBIACEAE (Coffee family). A number of genera are endemic (found only in Hawaii).
Kadua, large endemic genus of shrubs.
Gouldia, manono; shrubs and small trees; small endemic genus.
Gardenia, nanu; fragrant white flowers; some cultivated species.
Bobea, ahakea; native shrubs and trees.
Plectronia, walahee or alahee; native shrubs.
Coffea, coffee; introduced about 1823.
Morinda, noni; small tree with fruit, used for medicine and dye by native Hawaiians. MacCaughey, Plant World, vol. 21, pp. 209-14, 1918, and vol. 2, pp. 42-57, 191-149, 1918.
Straussia, kopiko; endemic genus of trees with orange berries.
Coprosma, pilo; shrubs and trees; male and female flowers on different plants.
Cinchona, quinine tree; cultivated, introduced from Peru, 1868.
Ixora, large cultivated shrub with deep red flower clusters, and large leaves.

54. CUCURBITACEAE (Cucumber family).
Lagenaria, bottle gourd, ipu.
Cucurbita, large gourd, ipu nui, or calabash; also the cultivated squash, cucumber, pie-melon, etc.
Sicyos, anunu; native bur cucumber.

55. LOBELIACEAE. The famous "Lobelias"; herbs, shrubs and small trees, with milky juice. Several genera: Brighamia, Lobelia, Clermontia, Rollandia, Delissea and Cyanea; described and illustrated in Rock's Monograph . . . ,Bishop Museum Memoirs, vol. VII, No. 2, 1919.

56. GOODENIACEAE, Scaevola, naupaka; shrubs and small trees with half a trumpet-shaped flower. Rock, Torrey Botanical Club Bulletin, vol. 36, p. 648, 1919. Skottsberg, B. P. Bishop Museum, Bulletin 43, 1927.

57. COMPOSITAE. The most highly developed family of flowering plants. Many genera, including:

Adenostemma, kamanamana; shrub, common in lowlands.

Lagenophora, small herbs; Forbes, B. P. Bishop Museum, Occasional Papers, vol. VI, p. 301, 1918.

Erigeron, iliohe; common horse-weed or butter-weed.

Xanthium, cocklebur, or burweed; common weed with rough leaves and bur.

Lipochaeta, nene; herb with woody base.

Campylotheca, kokolau; shrub with yellow flowers, in rainforest.

Chrysanthemum, "white daisy"; cultivated shrubs with white or yellow flower head.

Bidens, "bur marigold" or "free ride"; seed capsule has two-pronged "sticker"; weed. See, Sherff, Botanical Gazette, vol. LXX, pp. 89-109, 1920.

Argyroxiphium, silversword and greensword; on high mountains only. Gray, Proc. American Acad., vol. 2, pp. 159-160, 1852.

Dubautia, naenae; endemic genus shrubs and small trees.

Raillardia, naenae; endemic genus shrubs and small trees.

Senecio, ragweed, or groundsel; common weed.

Eupatorium, pamakani, coarse shrub-by perennial overrunning many localities.

Sonchus, sow thistle or pualele.

Hesperomannia, Hawaiian thistle tree, 10-20 feet high; rare.

Artemisia, shrubs with much branching leaves. Skottsberg, B. P. Bishop Museum, Bulletin 43, 1927.

(Several other common weeds.)

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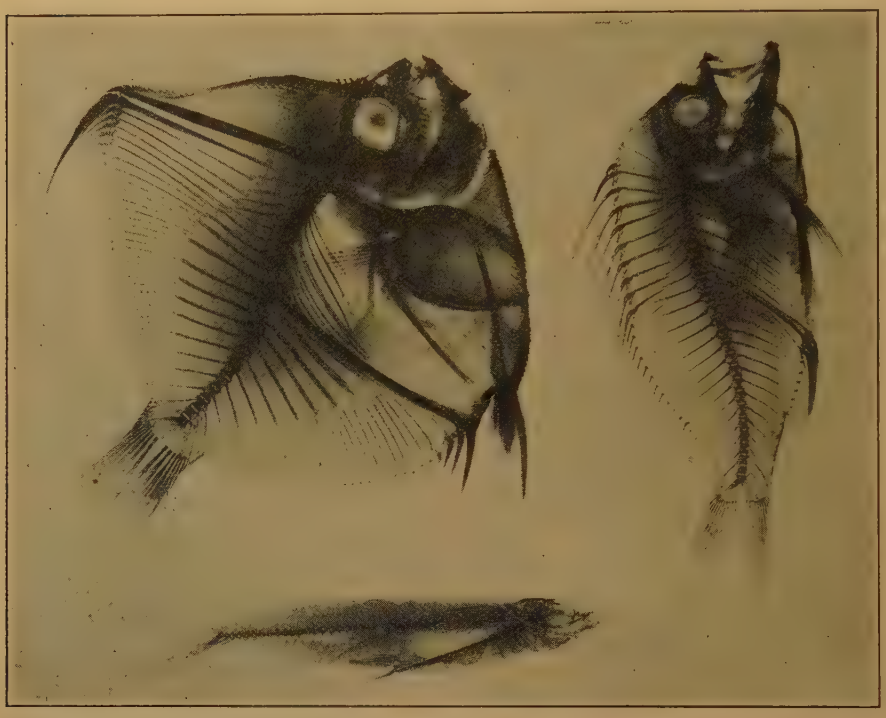
Human Breeding Advocated

A eugenic policy of public health, with a board of commissioners for its administration, was advocated recently by Hon. E. W. Montgomery, Manitoba minister of public health, and Dr. Alan Brown of Toronto, speaking before an open meeting of the Manitoba Medical Association, in annual convention.

Dr. Brown recommended the appointment of a provincial board of eugenics working in conjunction with such institutions as the university and the Manitoba equivalent of the prisons board. Dr. Montgomery spoke of a system of social selection which is growing in many provinces and states, and added that even the sterilization of mental defectives is being openly discussed in several parts of the continent.

"It is time," declared Dr. Montgomery, "that the screen of mystery was withdrawn from sex questions, for if men are to be preoccupied by such questions as, for instance, beer by the glass, the race must deteriorate."

Dr. Brown, in his address, charged parents with not being in the same class as the average farmer, because the latter at least pays attention to the breeding of healthy livestock. He lamented the fact that the federal government knew more statistics on pedigree'd livestock than on human births, and urged that every man and woman should know the record of at least twenty of his or her ancestors.



The X-ray of these fish was made in the X-ray laboratory of the Queens Hospital for Dr. Peischman, a Viennese scientist, who is in Hawaii studying fish.

X-Ray Pictures of Hawaiian Fish

A most interesting and original investigation is that being made by Dr. Viktor Pietschmann, distinguished Austrian Ichthyologist, who is a 1927-28 Yale Fellow at the Bishop Museum. In the course of studies on the structure and life-histories of Hawaiian fish, Dr. Pietschmann had an X-ray picture taken at the Queen's Hospital laboratory of one of the specimens. The result was so successful that quite a series of radiographs have been made, showing not only the bone structure but also the digestive tract, veins, arteries and other internal organs and systems. The images of the latter were made to show by injecting them with a barium compound solution. The Queen's Hospital has been most generous in cooperating in this work. It is hoped that an article on this valuable study will be forthcoming in an early science issue of this magazine. Dr. Pietschmann has given one or two talks at the Pan-Pacific Research Institution.

Some Injurious Insects of Formosa

By FRED C. HADDEN
Entomologist Hawaiian Sugar Planters' Association.

Formosa or Taiwan is a large island lying 96 miles southwest of Amoy, China. Its circumference is 973 miles with an area of 14,000 square miles. Most of the island is very mountainous, with dense forests of camphor, cypress, oaks, elms, and pines. Mount Niitaka is 13,700 feet high. The long axis of the island is north to south with the Tropic of Cancer crossing the middle.

The total population of Formosa is now about 4,000,000. Comprising about 3,700,000 Chinese, 200,000 Japanese, 30,000 foreigners and 200,000 savages.

About 3,000 square miles of land is cultivated. The most valuable products are sugar, camphor, rice, tea, lumber, gold, copper, coal, fish, oranges, pineapples and bananas.

Taihoku in north Formosa is the capital with a population of about 54,000 Japanese, 140,000 Chinese and 10,000 foreigners; total about 200,000. Taihoku is hotter in the summer and colder in the winter than Honolulu, and always very damp.

Camphor trees are attacked by:

Papilio sarpedon L. The caterpillars of this beautiful butterfly do great damage by completely defoliating the trees at certain times.

Athalia sp. A species of saw-fly also defoliates the trees.

Odontotermes formosanus. A termite attacking the roots, trunks and branches of camphor trees.

Icerya purchasi Mask.

Aulacaspis cinnamoni Newst. These two scale insects suck the sap from smaller branches.

Aleurodes spinosus. A white fly that also is a sap-sucker.

There are more than 19 species of harmful insects on camphor, but those listed are the most important.

OOLONG TEA

Oolong tea is one of the most valuable crops raised in northern Formosa. Hundreds of acres of hill and mountain lands are planted in tea. Any slope up to 50 degrees is cultivated as high as 3,000 feet.

Rainfall is depended upon for moisture supply.

There are 85 species of insects that attack tea in Formosa. The following are the most destructive:

Odontotermes formosanus. A termite that bores in the roots and stalks.

Andraca bipunctata Walk. Eupterotidae.

Euproctis conspersa Butl. Lymantriidae. The caterpillars of these two insects defoliate tea plants.

Red and *Gray Spiders* or *Mites* which rasp the leaves with their mouth parts and suck out the juices of the plants are at times numerous enough to be destructive.

Helopeltis fasciaticollis Poppius.

Helopeltis cinchonae Mann. Are two bugs that suck sap from the tea.

Brachytrypes portentosus Licht. A cricket which eats leaves, stems and roots.

Empoasca flavescens Fab. A sap-sucking Jassid.

Homona menciana Walk. and *Odoxyphes privatana* Walk. are *Tortricids* whose larvae are leaf-skeletonizers.

Lactistica sp. an Oecophorid, and *Biston marginata* Matsm. a Geometrid. The larvae of these moths defoliate the plants.

Clania variegata—Psychidae.

Clania sp.—Psychidae.

Mahosena sp.—Psychidae. These are sap suckers.

Aelesthes induta Newm. Is a Cerambycid whose larvae bore into the stalks and roots of the tea.

SUGAR CANE

Sugar cane is raised mostly in southern Formosa. It is attacked by many more very destructive insects than is cane in Hawaii. These are the most destructive sugar cane insects in Formosa:

Moth stalk borers are:

Chilo infuscatellus Sm.

Eucosma schistaceana Sn. and *Diatraea striatellus* Sn. The larvae of these moths bore in the cane stalks and are very destructive.

Wireworms attack the roots.

Termites attack the stalks.

Woolly aphis (*Oregma lauigera*) suck the sap from the leaves.

Alissonotum impressicolle Ar. A Scarabaeid called the "cane grub" whose grubs eat the cane roots.

RICE

Rice is attacked by the following most destructive insects:

Lema melanopa and *Hispa armigera.* Chrysomelid beetles that chew the leaves.

Schoenobius incertellus. A tortricid.

Chilo simplex—The "paddy borer."

Oxya velox—a defoliating grasshopper (also found in Hawaii).

Leafhoppers—3 species of sap-suckers.

BANANAS

Bananas are attacked by:

Cosmopolites sordidus a recently accidentally introduced root and stalk beetle-borer.

Pentalonia sp. An aphis sap-sucker on the leaves.

PINEAPPLES

Pineapples are attacked by mealybugs and scale insects. They also have "wilt."

ORANGES

Oranges are attacked by:

Melanauster chinensis. A large black beetle whose larvae bore in the trunk and branches.

Dacus dorsalis and two other species of fruitflies bore in the fruit.

Scale insects—of several species on the leaves and twigs suck the sap of the trees.

Formosa is a real "bug-hunter's Paradise." Insects of all kinds are very numerous. For each species of destructive insect in the Hawaiian Islands there are at least twenty-five species of destructive insects in Formosa. The inhabitants of the Hawaiian Islands may well be proud of their foresight in establishing the efficient quarantine service that prevents the introduction of these destructive insects into Hawaii.

Pacific Entomological Survey

A great setback to the work of the Pacific Entomological Survey was received in the sudden death last summer of Prof. Charles Fuller Baker, dean and professor of tropical agriculture of the College of Agriculture, University of the Philippines. Professor Baker had agreed to come to Hawaii to take charge of the work of this survey, and was preparing to leave the Philippines at the time of his death.

The committee in charge of the survey has succeeded in securing Mr. J. Philpott Mumford, English entomologist, now conducting special research at the University of California, and field work will be begun in May.

A graduate of the University of Hawaii is at present engaged in the task of compiling a list of the insects already recorded from islands of the Pacific, as a background for the work of the survey.

The Pan-Pacific Research Institution is planning to hold a Pan-Pacific Entomological Congress, inviting the leading entomologists and plant pathologists in Pacific lands as its house guests for a month of conference and acquaintance.

Food and Flora of Australia

(Address of Dr. R. H. Cambage, President of the Australasian Association for the Advancement of Science).

A synopsis of two most important pepers read before the Australasian Association for the Advancement of Science have been forwarded to the Pan-Pacific Research Institution by their author, R. H. Cambage, C.B.E., F.L.S. Royal Society, who so successfully headed the second Pan-Pacific Science Congress, held in Australia.

The synopsis of each is published as the first deals with food production, the second with the flora of Australia, most valuable data for those interested in the Pan-Pacific Botanic Garden in Hawaii, using every elevation from sea level to an altitude of ten thousand feet or more for acclimatization of plants and trees from every Pacific land.

Science and Primary Production

In his presidential address to the Australasian Association for the Advancement of Science at Hobart, on January 16, 1928, Mr. R. H. Cambage referred to the great need for the further application of science to primary production. This, he said, embraced such fundamental utilities as the production of grain, fruit, butter, wool and meat, and he stated that it was a matter for satisfaction that the commonwealth and state governments, as well as private bodies, were showing increased appreciation of the value of science to these problems.

He mentioned that a few years ago a thorough knowledge of dairy bacteriology and its application to the production of butter, had resulted in increasing the output of first grade butter in New South Wales from 48 to 96 per cent.

When referring to wheat, he said: "It is difficult to find anything among the primary products of Australia which owes more to science than wheat production. This is a matter of national concern, and it is most comforting to know that the great pioneering work carried out by William James Farrer is not only being continued at departmental experiment farms and universities, but with most progressive results. New and better drought and rust-resisting varieties of wheat and other grain are being produced, and experiments are being made for the purpose of breeding rust and flag-smut resisting plants which will also have other good characters."

Mr. Cambage referred to the action of the pastoralists in arranging for the Australian Pastoral Research Trust to receive a contribution at the rate of two shillings a bale of the 1927 wool clip, with the hope of rasing £200,000, for scientific research in connection with the industry. This action he regards as a most definite advance in Australia in the recognition of the benefits of science.

He commended the recent action of the federal government in inviting five leading pastoralists to act as a committee to enquire into the conditions of the pastoral industry in Australia, and advise on the best methods of conserving the national wealth represented by the industry. It provides, he stated, further evidence that the authorities concerned are quite alive to the necessity of abandoning the old happy-go-lucky methods of trusting to chance in regard to seasons, but rather look for the inrtoduction of some reasonable scheme of insurance that may have for its object the avoidance of excessive losses rather than the making of enormous profits.

He concluded the first portion of his address by saying that it is the desire

of the Australasian Association for the Advancement of Science, which includes New Zealand, to inspire and stimulate a science sense in the public mind, and this, he thought, could best be done by demonstrating how the principles of pure science may be applied successfully to familiar economic problems.

Origin and Development of Portion of the Australian Flora

In the second part of his presidential address before the Australasian Association for the Advancement of Science at Hobart, delivered on January 16, 1928, Mr. R. H. Cambage discussed the "Origin and Development of Portion of the Australian Flora."

He summarized the position as follows: "There appear to be more genera common to Africa and the eastern half of Australia only, than to Africa and the western half of Australia only, so that evidence of a direct land connection between these two countries is meager.

"It is thought that many genera which are common to Africa and Australia have reached these countries from the same source in the north, and have then developed in response to environment.

"From available evidence it would seem that, at least since Cretaceous time, the northern hemisphere has had a greater land mass than the southern, and, as a result, there has been more room for plant development in the north than in the south. Probably the Pleistocene and even earlier glacial periods have been instrumental in permitting many genera to pulsate across the tropics from temperate northern regions, and in the process, and after arrival in the south, there have been much radiation, development and evolution. Although there probably has been more migration to Australia from the north, there is evidence in some cases of secondary radiation from the south, especially in the genus *Eucalyptus*.

"It seems undoubted that some genera common to Australia and New Zealand have reached both countries from the north, some species coming down the east coast of Australia, while others have gone by way of New Caledonia and adjoining islands to New Zealand.

"Except for a land connection between northeastern Australia and islands to the north, perhaps as late as Pliocene time, Australia has long been isolated from the rest of the world.

"There appears to be more evidence in favor of a former land connection between Antarctica and South America, and perhaps New Zealand and Australia, than between Africa and Antarctica.

"Studies of the many changes which have taken place in the history of the world's flora, of its adaptability to environment, its response to changes of climate and soil, its ability to overcome many adverse conditions, all combine to impress one with the conviction that the marvellous act of creation not only embodied the initial giving of life, but also provided inherent power and initiative for the necessary development and evolution required for the persistence of that life, in harmony with its varying surroundings, and dominating influences."